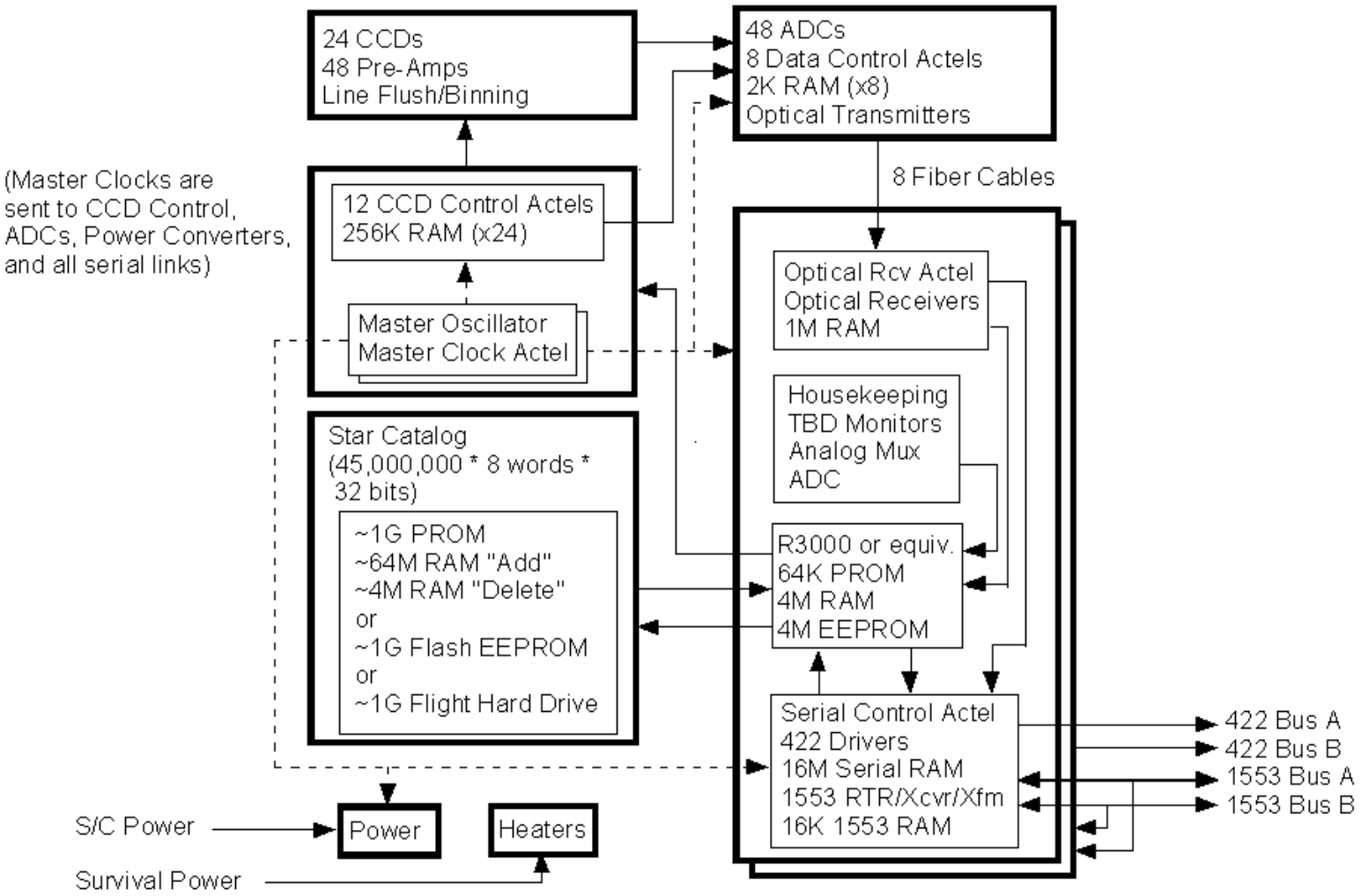
FAME Instrument On-Board Processing Design Comparison

(3/31/99)

FAME Star Catalog Configuration



Star Catalog Description

- In the Star Catalog configuration, FAME uses the on-board star position information to select which of the stars will be in the field of view prior to the frame readout. With this information, only the pixels which will have stars are digitized, reducing the ADC power consumption and the data throughput rate between the analog front-end and the digital back end. In addition, the binning control can be altered to center a star in the 5 column bin, instead of having small stars straddle multiple bins. Only the previously determined bright stars are sent to the computer for centroiding calculations, all other windows are sent directly to the serial output link. CCD lines without any windows will be charge-flushed without requiring front or back end processing. The star catalog will either be 100% non-volatile alterable memory (EEPROM or hard drive), or 7/8 fuse-link PROM with 1/8 RAM to make changes. The star catalog is organized in “tiles” of the sky to reduce processing time required.

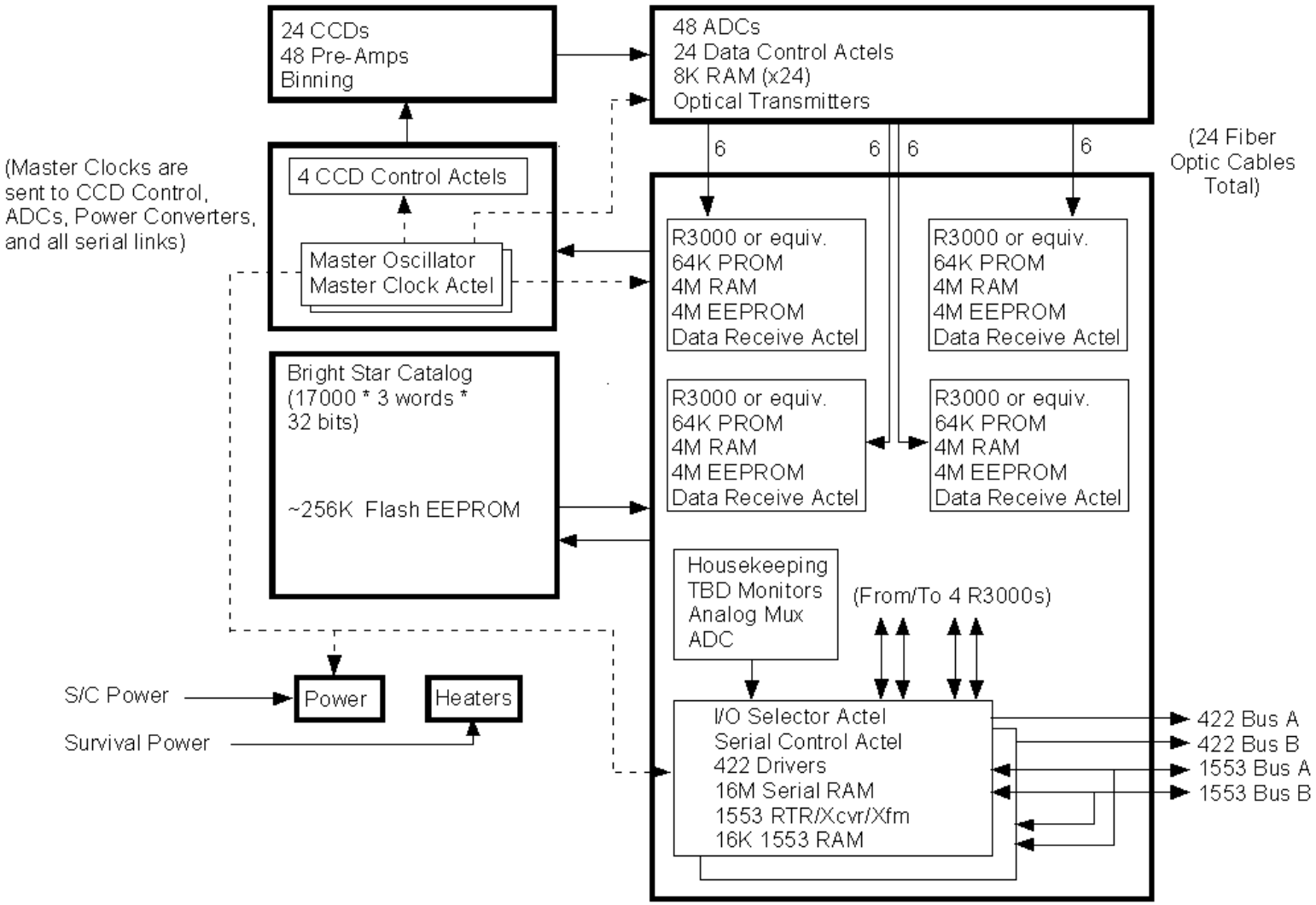
Star Catalog Pros

- Reduced power consumption
  - ADC's and remaining front-end electronics run only 0.2% of the time
  - Only one hot computer instead of 4
- Pre-determined maximum amount of downlink data
  - 306 stars maximum per CCD
  - Total of 306 stars * 24 CCDs * 5.25 rows * 3.25 bins * 18 bits + 10% overhead = 2,481,079 bits-per-second
- Rate is the same if looking near/at the Earth/Moon/Venus/Jupiter/Sun
- Greater redundancy
- Fewer fiber optic links
- Reduced digital electronics in front end (lower noise)
- Can look at stars much closer to the edge of Earth/Moon/Venus/Jupiter/Sun
- Ignores pixel defects and radition hits unless the event overlaps a star
- Can adjust ADC gain control for each bin

Star Catalog Cons

- Requires large star catalog with possibly difficult-to-acquire devices
- No targets-of-opportunity unless they are uploaded

FAME Threshold Configuration



Threshold Description

- In the threshold mode, all bins are digitized and digitally compared in the front end to a programmed threshold level. If a bin is found to exceed the threshold, a surrounding 5 by 3 window is sent to the back end electronics. Stars which exceed a single pixel will have a correspondingly larger window returned. All of the data will need to be processed in the back-end computers to determine which stars are bright enough to be used for centroiding calculations.

Threshold Pros

- Requires much smaller star catalog
- Returns data on planets, galaxies, comets, and targets-of-opportunity

Threshold Cons

- Higher power required
  - All pixels digitized
  - 4 hot computers
- Larger number of Actels required
- Larger amount of downlink data
  - Assuming the same objects as catalog mode, total of 306 stars * 24 CCDs * 6 rows * 4 bins * 26 bits + 10% overhead = 5,040,922 bits-per-second
  - Maximum amount of data if looking at/near Earth/Moon/Venus/Jupiter/Sun = 3000 rows * 410 bins * 24 CCDs * 26 bits + 10% overhead = 844,272,000 bits-per-second (note: after the 16MB serial buffer is filled, all other data is dropped)
- Reduced redundancy (no backup computers)
- Grater number fiber optic links to handle the increased front-to-back-end data links
- Requires computer link into front end to adjust thresholds (increased noise)
- System is “blinded” near/over Earth/Moon/Venus/Jupiter/Sun
- Records all pixel defects and radition hits as data
- Requires 17-bit ADC to cover full range instead of using gain control